IN THE CLAIMS:

1. (currently amended) A method of determining a gap defined between an eddy current proximity transducer and a target, said method comprising:

populating a data structure with data points that are relative to a predetermined target property including at least one of a target conductivity, a target material composition, a target surface treatment, and a target permeability;

determining a complex impedance value of the transducer relative to a plurality of selected data structure data points; and

determining at least one of a target material property and the gap based on an interpolation of the plurality of selected data structure data points relative to the complex impedance value.

2. (canceled)

3. (original) A method in accordance with Claim 1 wherein populating a data structure with data points that are relative to a predetermined target property comprises populating the data structure with data that corresponds to a complex impedance value of the transducer.

4. (original) A method in accordance with Claim 1 wherein populating a data structure with data points that are relative to a predetermined target property comprises populating the data structure with data points that define a plurality of curves.

5. (original) A method in accordance with Claim 1 wherein the data structure data points define a plurality of curves and wherein determining the complex impedance value of the transducer relative to a plurality of selected data structure data points comprises:

selecting a first data point that lies on a first of the plurality of curves;

selecting a second data point that lies on a second of the plurality of curves, such that the complex impedance value lies between the first of the plurality of curves and the second of the plurality of curves; and

interpolating between the first data point and the second data point to determine the complex impedance value of the transducer.

6. (original) A method in accordance with Claim 5 wherein interpolating between the first data point and the second data point comprises interpolating between the first data point and the second data point using linear projection.

7. (original) A method in accordance with Claim 1 wherein the data structure data points define a plurality of curves and wherein determining the complex impedance value of the transducer relative to a plurality of selected data structure data points comprises:

selecting at least one first data point that lies on at least one of the plurality of curves;

selecting at least one other data point that lies on at least one other of the plurality of curves wherein the at least one other curve is different than the at least one curve; and

interpolating between the selected data points to determine the complex impedance value of the transducer.

8. (original) A method in accordance with Claim 1 wherein the data structure data points define a plurality of curves and wherein determining the complex impedance value of the transducer relative to a plurality of selected data structure data points comprises:

selecting a first data point and a second data point that lie on a first of the plurality of curves;

selecting a third data point and a fourth data point that lie on a second of the plurality of curves wherein the second curve is different than the first curve; and

interpolating between the first data point, second data point, third data point, and fourth data point to determine the complex impedance value of the transducer.

9. (original) A method in accordance with Claim 8 wherein the complex impedance value is a data point that is bounded by line segments connecting adjacent ones of the first data point, second data point, third data point, and fourth data point and wherein interpolating between the first data point, second data point, third data point, and fourth data point to determine the complex impedance value of the transducer comprises using linear projection.

10. (original) A method in accordance with Claim 9 wherein using linear projection comprises determining an intersection line for each line segment that is normal to the line segment and includes the complex impedance value data point.

11. (original) A method in accordance with Claim 1 wherein populating a data structure with data points that are relative to a predetermined target property comprises populating the data structure with data points that correspond to a plurality of transducer excitation frequencies.

12. (original) A method of determining a gap defined between an eddy current proximity transducer and a target, said method comprising:

populating a data structure with data points that are relative to at least one of a target conductivity, a target material composition, a target surface treatment, and a target permeability wherein the data points correspond a complex impedance value of the transducer;

selecting a first data point that lies on a first of the plurality of curves;

selecting a second data point that lies on a second of the plurality of curves, such that the complex impedance value lies between the first of the plurality of curves and the second of the plurality of curves; and

interpolating between the first data point and the second data point to determine the complex impedance value of the transducer; and

determining at least one of a target material property and the gap based on an interpolation of the plurality of selected data structure data points.

13. (original) A method in accordance with Claim 12 wherein populating a data structure with data points that are relative to at least one of a target conductivity, a target material composition, a target surface treatment, and a target permeability comprises populating the data structure with data points that define a plurality of curves.

14. (original) A method in accordance with Claim 12 wherein interpolating between the first data point and the second data point comprises interpolating between the first data point and the second data point using linear projection.

15. (currently amended) A system for determining a gap defined between an eddy current proximity transducer and a target, said system comprising:

a memory comprising a data structure with data points that are relative to a predetermined target property comprising at least one of a target conductivity, a target material composition, a target surface treatment, and a target permeability; and

a processor configured to:

control execution of instructions to determine a complex impedance value of the transducer relative to a plurality of selected data structure data points; and

control execution of instructions to determine at least one of a target material property and the gap based on an interpolation of the plurality of selected data structure data points.

16. (original) A system in accordance with Claim 15 wherein said processor is further configured to control execution of instructions to populate a data structure with data points that are relative to a predetermined target property.

17. (original) A system in accordance with Claim 15 wherein said processor is further configured to control execution of instructions to determine a complex impedance value of the transducer relative to a plurality of selected data structure data points.

18. (original) A system in accordance with Claim 15 wherein said processor is further configured to control execution of instructions to determine at least one of a target material property and the gap based on an interpolation of the plurality of selected data structure data points relative to the complex impedance value.

19. (canceled)

20. (original) A system in accordance with Claim 15 wherein said data structure comprises data points that correspond to a complex impedance value of the transducer.

21. (original) A system in accordance with Claim 15 wherein said data structure comprises data points that define a plurality of curves, said processor further configured to:

select at least one first data point that lies on at least one of the plurality of curves;

select at least one other data point that lies on at least one other of the plurality of curves wherein the at least one other curve is different than the at least one curve; and

interpolate between the selected data points to determine the complex impedance value of the transducer.

22. (original) A system in accordance with Claim 15 wherein the complex impedance value is a data point that is bounded by line segments connecting adjacent ones of said selected data points, said processor further configured to interpolate between using linear projection.

23. (original) A system in accordance with Claim 15 that is substantially insensitive to variations in the target material properties.

24. (original) A system in accordance with Claim 15 that is substantially insensitive to variations in the target chrome coating.

25. (original) A system in accordance with Claim 15 that is configured to determine the target material type and gap substantially simultaneously for a plurality of material properties.

26. (currently amended) A system for determining a gap defined between an eddy current proximity transducer and a target, said system comprising:

a network comprising said transducer serially coupled to an electrical component;

a signal generator circuit operatively coupled to said network, said signal generator circuit configured to drive a current that includes a plurality of frequency components through said network wherein a first analog voltage is impressed across said network and a second analog voltage is impressed across said transducer;

a sampling and digitizing circuit coupled to said signal generator circuit, said sampling and digitizing circuit configured to convert the first analog multi-frequency voltage impressed across said network and said second analog multi-frequency voltage impressed across said transducer into a plurality of digitized voltages;

a convolution circuit comprising an input terminal corresponding to at least one of the plurality of component frequencies, said convolution circuit configured to convolve each digitized voltage with a digital waveform for forming a first complex number and a second complex number correlative to the first analog voltage and the second analog voltage respectively for at least one of the component frequencies;

a memory comprising a data structure with data points that are relative to a predetermined target property <u>comprising at least one of a target conductivity, a target material composition, a target surface treatment, and a target permeability</u>; and

a processor configured to:

control execution of instructions to determine a complex impedance value of the transducer relative to a plurality of selected data structure data points; and

determine at least one of a target material property and the gap based on an interpolation of the plurality of selected data structure data points using linear projection.